THERMOSPHERE, IONOSPHERE, MESOSPHERE ENERGETICS AND DYNAMIC MISSION (TIMED) PROGRAM IMPLEMENTATION PLAN

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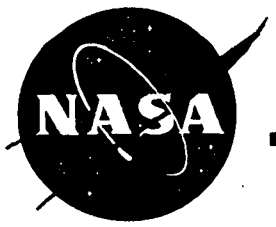

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Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics Mission (TIMED) Program Implementation Plan

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Introduction

Goddard Space Flight Center (GSFC) has been assigned the Program Management responsibility for the Thermosphere, Ionosphere, Mesosphere Energrtics and Dynamics (TIMED) Mission by Office of Space Science (OSS) at NASA Headquarters. The Program Office resides in the Space Science Program Office (Code 180) and the NASA Mission Office charged with the implementation of the TIMED mission at the Johns Hopkins University / Applied Physics Laboratory (JHU/APL) resides in the Flight Projects Directorate. This plan recognizes JHU/APL's role in the implementation of the Project and describes the relationship between all participants in the Program during the life of the Project.

Program and Mission Objectives - The objective of the TIMED Mission is to explore the mesospheric and lower thermospheric (MLT) region between 60 and 180 kilometers, and to understand its response to variable energy inputs from both above and below. The MLT region is the least explored region of the Earth's atmosphere and is influenced strongly by the highly varying solar ultraviolet and X-Ray radiation, auroral particles and fields, and the upward propagating waves and tides from the lower atmosphere.

Within the Sun-Earth Connection Theme, there are 6 central questions that focus on the MLT region:

(1) The basic structure of the region - What is the temperature, wind, and density structure as a function of altitude and latitude?
(2) The energy balance within the MLT region - What are the sources and sinks of energy within the region?
(3) The variability of the MLT region - What are the diurnal, seasonal, and annual variations as well as the variation with the 11 year solar cycle and the long term variation?
(4) The perturbations of the MLT region due to solar variations - How does the solar variability affect the MLT structure?
(5) The perturbations of the MLT region due to forcing functions produced in the lower atmosphere - How does lower atmospheric small-scale waves (gravity waves) and large scale waves (tides and planetary) affect the MLT structure?

(6) The perturbations of the MLT region due to anthopogentic activities - How does increasing the concentrations of anthropogenically produced greenhouse gases change the MLT structure?

The TIMED Mission will establish a foundation of knowledge upon which these questions and other issues can be addressed. The TIMED instrument compliment consists of:

Instrument	Measurement
- Solar EUV Experiment (SEE)	Solar Input
- TIMED Doppler Interferometer (TIDE)	Neutral Winds
- Global Ultraviolet Imager (GUVI)	Thermospheric temperatures and composition, Joule heating and auroral particle input
- Sounding of the Atmosphere Using Broadband Emission Radiometry (SABER)	Infrared emissions, Mesospheric compositions and temperatures
- Collaborative Measurements	Gravity waves, Joule heating, Tidal aliasing

The TIMED Project also includes an Interdisciplinary Science Team who will study the magnetospheric input, airglow processes, system dynamics, tidal and planetary wave input, gravity wave effects, and chemistry with the objective of fully understanding the mesosphere and lower thermosphere region and its interactions and relationships with the atmospheric layers both above and below.

Program Content and Elements - The TIMED Mission is intended to be the first in a series of Solar Terrestrial Probe Missions and as such is the pathfinder for the management approach as well as the mission

science. The TIMED Mission consists for four elements. The elements are (1) the four science instruments, (2) the spacecraft, (3) the launch service, and (4) the mission operations. The Johns Hopkins University / Applied Physics Laboratory (JHU / APL) is responsible for all elements of this mission with the singular exception of the launch service which is provided by the Orbital Launch Services (OLS) Project at Goddard Space Flight Center.

Background and Organization - JHU / APL was assigned the responsibility to define the downsized TIMED Mission by NASA HQ in 1994. At that point, JHU/APL undertook the overall management of the mission definition which included the definition and preliminary design of the spacecraft, the definition and development of the 4 remaining science investigations, and the development of a mission operations concept.

NASA Headquarters (Office of Space Science) assigned GSFC the responsibility for the management of the TIMED Mission implementation at JHU/APL during the fall of 1996. The TIMED Program is capped at $129.3M in real year dollars as outlined in table 1. The GSFC POP guidelines are to include the SABER instrument funding. NASA has assigned the responsibility for instrument development management to the GSFC / JHU / APL Team and the Team must have control of the total instrument budget. The transfer of funds to LaRC for SABER will remain within the Agency.

This assignment is consistent with the Administrator's direction to transfer program responsibilities and project implementation to the field centers. This delegation also included the establishment of a contractual relationship with JHU/APL to continue the work previously funded by NASA HQ through a Navy contract with JHU/APL.

GSFC Management Approach - In recognition of JHU/APL's demonstrated performance, GSFC intends to maintain a minimum oversight while executing the Centers fiduciary responsibility for the federal funds involved. The TIMED organization is presented in Figure 1. JHU/APL is responsible for the development and operation of the TIMED mission and, as such, will be held responsible for the mission success. JHU/APL has established a Project Office to manage

Table 1. TIMED Development Budget (NOA / $K)

	FY97	FY98	FY99	FY00	Total
APL Funding	22,650	43,196	28,288	6,848	100,982
-Spacecraft & Integration	(18,648)	(31,470)	(23,305)	(5,071)	(78,494)
- GUVI	(1,313)	(4,368)	(1,543)	(640)	(7,864)
- TIDI	(1,509)	(5,023)	(2,183)	(638)	(9,353)
- SEE	(1,180)	(2,335)	(1,257)	(499)	(5,271)
Saber	3,150	8,268	3,535	930	15,883
TIMED Mission Funding	25,800	51,464	31,823	7,778	116,865
Inter-Disciplinary Science Team	0	400	600	300	1,300
Contingency	0	0	7553	1500	9,053
GSFC Support	100	150	150	100	500
HQ. Taxes	0	686	674	222	1,582
Total TIMED Budget	25,900	52,700	40,800	9,900	129,300

( ) - non add cost break down

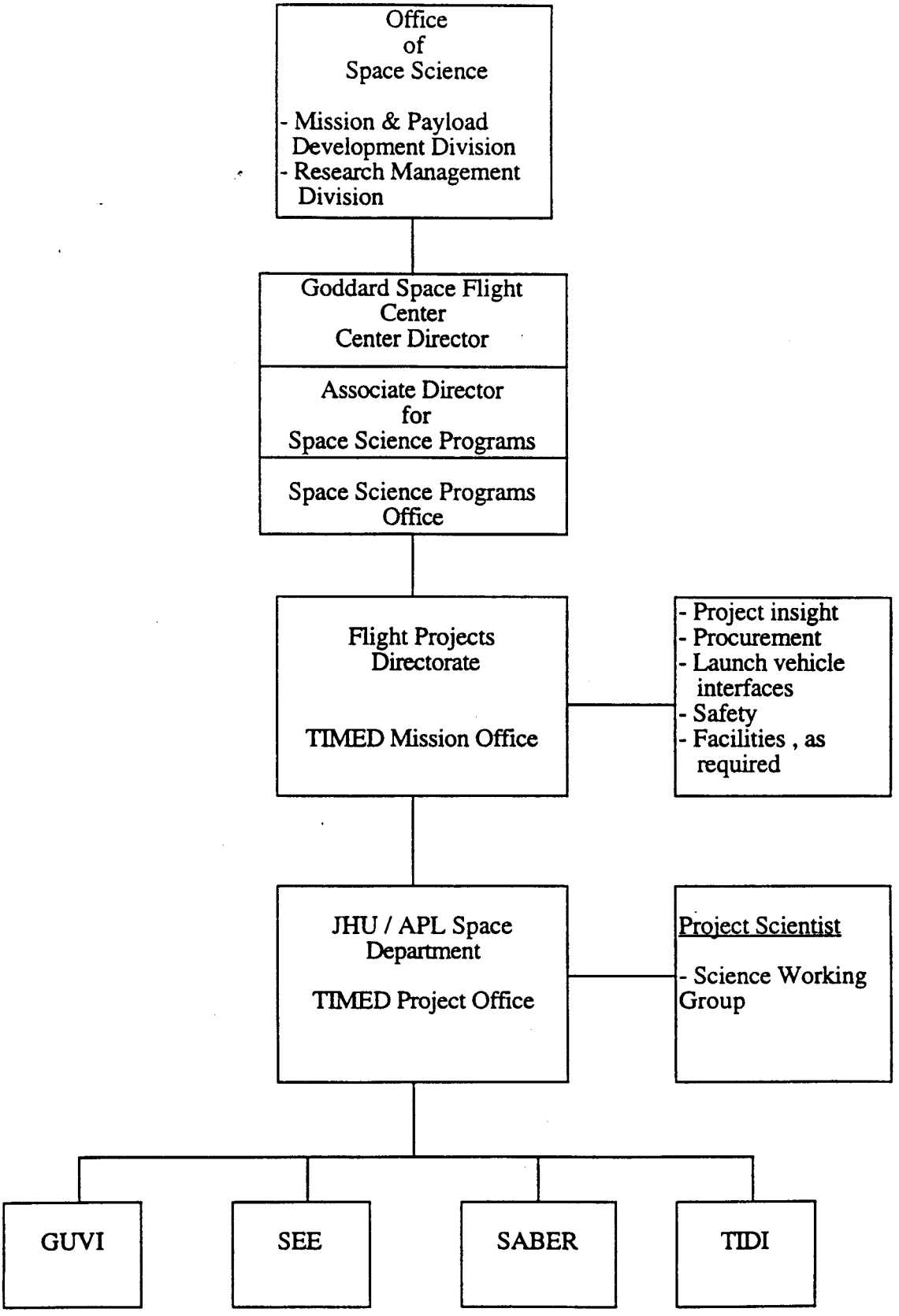


Figure 1. TIMED Management Team Organization

the design, development, fabrication, assembly, integration, and test of the TIMED spacecraft; to manage the development, integration, and operation of the four selected TIMED instruments; to provide launch support for the mission; and to manage the operation of the TIMED satellite for the duration of the prime mission (24 months). JHU/APL shall appoint, with NASA's concurrence, a Project Manager and a Project Scientist for this mission. The Project Scientist shall organize and chair a Science Working Group consisting of the four instrument Principal Investigators and the Interdisciplinary Science Team and will advise the JHU/APL Project Manager on issues affecting the implementation of the science objectives for the mission.

The following guidelines apply to the GSFC organization staffing.

Project Staffing at GSFC

- TIMED Project Manager	full time	1 FTE
- Resources Manager	part time	
- SR&QA Representative	part time	
- Contracts Specialist *	part time	
- System Engineer	part time	
- Total average staffing		~ 3 FTE

* - The initiation of the contract(s) in FY97 will drive these FTE numbers higher this year.

TIMED Program Authority and Accountably

Within NASA - Program authority is delegated from the Associate Administrator for Space Science through the Goddard Center Director to the Associate Center Director for Space Science and the TIMED Program Manager. The Project responsibility is delegated to the TIMED Mission Office within the Flight Projects Directorate. The TIMED Mission Office is responsible for the NASA management and oversight of the TIMED mission development and implementation at JHU / APL.

In accordance with the NASA Strategic Management Handbook (October 1996), NASA Headquarters retains the responsibility for

establishing overall policy for the flight programs, soliciting and selecting investigations and instruments, establishing Level 1 program and science requirements, allocating budget, and evaluating program performance and financial status.

Within Goddard Space Flight Center - The GSFC Center Director is responsible for the overall program success and is accountable to the Associate Administrator for Space Science. The Director holds the Associate Director for Space Science Programs accountable for directing a program that meets the Agency and Center requirements and the TIMED Mission Manager accountable for the development and implementation of the mission at JHU / APL and the execution of the mission objectives within the establish cost and schedule limits. The TIMED Mission Office is also responsible for funding the Interdisciplinary Science Team working in parallel with the instrument Principal Investigators, facilitating the annual funding of SABER at Langley Research Center based on the recommendations of the JHU / APL Project Manager, and coordinating the launch service with the Orbital Launch Services Office and the Mission to Planet Earth Program Office at GSFC. TIMED is co-manifested with the JASON Mission on a Delta launch vehicle in May 2000.

Agency requirements, including reviews to determine Mission Readiness and Mission Success, are found in NHB 7120.5, Management of Major Systems Programs and Projects. This document is under revision to reflect the transfer of Program Management responsibility from NASA Headquarters to the field centers.

Within JHU / APL - The Applied Physics Laboratory of Johns Hopkins University is selected to develop the TIMED mission and to operate the spacecraft and instruments for the duration of the prime mission (24 months). JHU / APL is responsible for the overall mission development including the spacecraft, 4 selected science instruments, ground systems necessary to operate the satellite all within the cost cap established by NASA. JHU / APL is expected to make the cost and technical trades as well as descope recommendations necessary to stay within the cost cap while still meeting the science objectives of the mission. The responsibility for implementing the TIMED

Mission is assigned to the TIMED Project Office within the Space Department.

Review and Reporting Requirements

The following review and reporting requirements are placed on JHU/APL to provide the necessary visibility into the development activities and to satisfy the need to keep all parties within NASA informed.

Project Reviews - GSFC personnel will attend both the spacecraft and instrument reviews as appropriate and feasible within the limits of travel resources. The four major Project Reviews (PDR, CDR, PER, & PSR) will be co-chaired by APL and GSFC as outlined in table 2. The fifth project review (MOR) is traditionally chaired by GSFC. This set of reviews are necessary to insure that an adequate level of knowledge exists to support the flight readiness certification prior to launch.

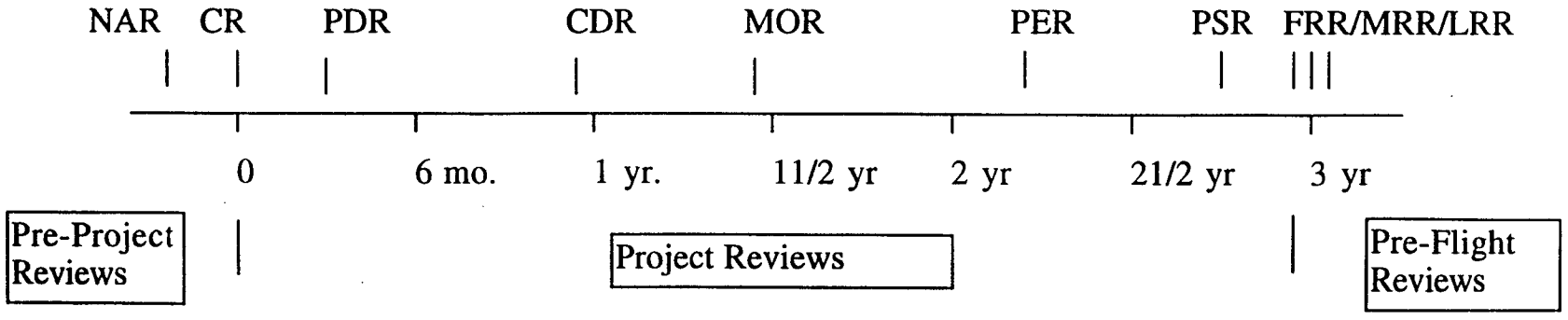
The GSFC technical comments arising from these project reviews will be provided to APL but will not be considered mandatory. APL will be required to address each technical comment by either defining how they will implement it or by stating the rationale and risk assessment for not implementing the technical comment. Only in extraordinary circumstances will GSFC direct APL to make a technical change.

Pre-Flight Reviews - The Pre-Flight Reviews (FRR / MRR / LRR) address the total mission including the launch vehicle, range as well as the spacecraft and are chaired by NASA personnel.

Mission Readiness Review (MRR) and Readiness for Flight Certification - The Office of Space Science also delegated to the Center Directors in the fall of 1996 the responsibility for conducting the Mission Readiness Review and certifying the flight readiness for each Space Science Mission assigned to the Center. The GSFC Deputy Center Director chairs the Mission Readiness Review and determines based on that review the readiness of the mission for launch. APL is responsible for the briefing the status of the spacecraft and instruments, the Orbital Launch Systems Office is responsible for

Table 2. TIMED Mission Related Reviews

Mission Related Reviews	Review Chairperson	Requirement Driver
Non-Advocacy Review (NAR)	NASA	Dep. Admin/ PMC
Confirmation Review (CR)	AA for Space Science	Code S
Preliminary Design Review (PDR)	APL/Code 300	GSFC / NMI
Critical Design Review (CDR)	APL/Code 300	GSFC / NMI
Mission Operations Review (MOR)	Code 300	GSFC / NMI
Pre-Environmental Review (PER)	APL/Code 300	GSFC / NMI
Pre-Ship Review (PSR)	APL/Code 300	GSFC / NMI
Flight Readiness Review (FRR)	NASA	GSFC / NMI
Mission Readiness Review (MRR)	Dep. Cntr. Director	Code S
Launch Readiness Review (LRR)	NASA	GSFC / NMI



briefing the readiness of the launch vehicle and range preparations, the GSFC Mission Manager will provide an assessment of the mission readiness from his prospective. In parallel, Code 300 will prepare the Flight Readiness Report (a.k.a. the Red Book) summarizing the results of the project reviews and identifying any residual risk to mission success.

Based on the results of the MRR and the Flight Readiness Report, the Space Science Program Office will prepare a letter to the Associate Administrator for Space Science certifying the mission readiness for flight for the Center Director's signature. Consistent with the delegation of added responsibility to APL, the Space Department Manager at APL will be asked to co-sign this certification letter.

Unique Documentation Requirements - The Office of Space Science requires the provision of the following information on a routine schedule and this requirement is passed on to JHU/APL:

- Weekly Project Status statement due electronically on Friday of each week beginning with the CDR

- Monthly Program Review which provides a more in-depth status review including financial status (cost performance), available reserves, significant progress, problems, etc.

The NASA Mission Manager has determined that the existing APL documentation is adequate for the development phase of the mission and no additional documents beyond those already planned and routinely available and are required for this project.

Transfer of the Headquarters Contract Responsibilities with JHU/APL to GSFC - NASA Headquarters has maintained a contractual relationship with JHU/APL for a number of years through an existing Navy contract with JHU/APL. The scope of this contractual relationship included NEAR, TIMED definition, several MO&DA activities, etc. GSFC has agreed to implement a direct contract with JHU/APL for the execution of the existing tasks, TIMED development

and operations, and any new work that NASA chooses to award JHU/APL in the future. NEAR management will remain at NASA Headquarters. The task justification, procurement paper work, and technical management of the individual MO&DA tasks and other tasks not assigned to Goddard will be the responsibility of the individuals initiating the tasks. Goddard will provide the contracting vehicle but assumes no management responsibilities for activities not assigned to GSFC for implementation.

Program Interface Relationships

NASA Headquarters - NASA Headquarters has the responsibility for establishing Program policy, soliciting and selecting missions and instruments, allocation of the Program budget, control of Level I items, and assessing and evaluating the Program performance and financial status. NASA Headquarters also has the responsibility for establishing the formal agreements with other US Government organizations and with foreign space organizations and institutions. The Associate Administrator for Space Science has delegated the above programmatic responsibilities to the Mission and Payload Development Division (SD) at NASA Headquarters.

Level I requirements for the TIMED Mission are set forth in a NASA Headquarters controlled Program Requirements document.

Goddard Space Flight Center - GSFC is responsible for the Level II activities associated with the TIMED Mission. The Level II requirements are controlled by the Goddard Mission Manager while the Level III requirements are controlled by the JHU / APL Project Manager.

The budget process is carried out each year through the Program Operating Plan (POP) process beginning with a set of guidelines defined by NASA Headquarters and resulting in an agreed to budget and technical content for the balance of the project. Resource requirements are described by the Project for development and prime mission operations and are defined as including funding, man-power, facilities, technical, and institutional support, launch facilities, and other resources as required for the implementation of the Project. Project risks and liens are indicated as well. GSFC will

provide the oversight of the project implementation at JHU / APL, coordinate the interface with the launch service, and facilitate the relationship between JHU / APL and Langley Research Center the provider of the SABER instrument.

Johns Hopkins University / Applied Physics Laboratory - JHU / APL is responsible for the development and prime mission operations of the TIMED Project. JHU / APL will manage all aspects of the development activities including the development of the four science instruments and the prime mission operations. JHU / APL will be held responsible for mission success. The TIMED Project Office works directly with its Goddard counter part to insure the adequate flow of information between NASA and JHU / APL and to insure the availability of resources to implement the mission. The JHU / APL Project Office is responsible for the outreach to both the scientific community and the public at large and is responsible for the dissemination of the knowledge gained from this mission is made available on the widest basis practical.

Science Community - The primary interface with the science community in areas of policy is the TIMED Program Scientist at NASA Headquarters. The primary interface with the science community in areas associated with the implementation of the TIMED mission is the Project Scientist at JHU / APL. The Project Scientist responsibilities are:

- advise the JHU / APL Project Manager and project staff on the scientific issues in the instrument development, spacecraft integration, and mission operations.

- provide day-to-day guidance to the TIMED Project Office as a representative of the science community

- consult with the Program Scientist at NASA Headquarters regarding project science objectives

- monitor activities within the TIMED Project to assure that the scientific objectives are being met

- lead the science outreach activities associated with TIMED and promote the dissemination of the knowledge gained through the project to the science community and the public at large

Relationship to Planning for the Solar Terrestrial Probe Program

This Program Implementation Plan may be superseded by or incorporated into the Solar Terrestrial Probe (STP) Program Plan when that document becomes available. The TIMED Project is the initial mission of the STP Program and will be an integral element of the Program Office when that office is approved and established.